

What is claimed is:

1. A fuel injection nozzle comprising:

a nozzle body that includes a fuel injection hole and a valve seat, wherein the valve seat is located on an inlet side of the fuel injection hole; and

a nozzle needle that includes an engaging portion, which is seatable against the valve seat to stop fuel injection through the injection hole, wherein:

the nozzle needle has a coating layer in an outer wall of the nozzle needle; and

the coating layer is made of a lipophobic material.

2. The fuel injection nozzle according to claim 1, wherein the coating layer extends distally from a predetermined point of the nozzle needle, which is located distally of the engaging portion.

3. The fuel injection nozzle according to claim 1, wherein the coating layer covers at least a portion of the engaging portion.

4. The fuel injection nozzle according to claim 1, wherein the coating layer is arranged to satisfy the following relationship:

$$T \leq 0.01 \times H,$$

where "T" is a thickness of the coating layer, and "H" is a distance between the nozzle body and the nozzle needle, which is measured at a narrowest cross sectional point in a fuel passage defined between the nozzle body and the nozzle needle on a

downstream side of an upstream end of the engaging portion when an amount of lift of the nozzle needle is maximized.

5. The fuel injection nozzle according to claim 1, wherein the nozzle body includes a nozzle plate, in which the fuel injection hole is formed, wherein a generally flat space is defined between the nozzle needle and the nozzle plate.

6. The fuel injection nozzle according to claim 5, wherein the coating layer is formed in a distal end surface of the nozzle needle, which is opposed to the nozzle plate.

7. The fuel injection nozzle according to claim 6, wherein the generally flat space is defined to satisfy the following relationship:

$$h \leq 1.5 \times d,$$

where "h" is a distance between the distal end surface of the nozzle needle and the nozzle plate in the generally flat space, and "d" is an inner diameter of the fuel injection hole formed in the nozzle plate.

8. The fuel injection nozzle according to claim 1, wherein the fuel injection nozzle is for a direct injection internal combustion engine, which has a combustion chamber and directly injects fuel into the combustion chamber.

9. The fuel injection nozzle according to claim 8, wherein a

distal end of the fuel injection nozzle is exposed in the combustion chamber.

10. A manufacturing method of a fuel injection nozzle, which includes a nozzle body and a nozzle needle, wherein the nozzle body includes a fuel injection hole and a valve seat, and the nozzle needle includes an engaging portion, which is provided in a distal end of the nozzle needle and is seatable against the valve seat to stop fuel injection through the injection hole, the manufacturing method comprising:

soaking the distal end of the nozzle needle in a liquid state lipophobic material to a predetermined depth to apply the lipophobic material to the distal end of the nozzle needle.

11. The manufacturing method according to claim 10, further comprising rotating the nozzle needle about an axis of the nozzle needle in a circumferential direction of the nozzle needle when the lipophobic material applied to the distal end of the nozzle needle has liquidity.

12. The manufacturing method according to claim 10, further comprising rotating the nozzle needle about a perpendicular axis, which is perpendicular to the axis of the nozzle needle, when the lipophobic material applied to the distal end of the nozzle needle has liquidity.

13. The manufacturing method according to claim 10, further

comprising blowing air to the lipophobic material applied to the distal end of the nozzle needle.

14. The manufacturing method according to claim 10, further comprising cutting at least a portion of the lipophobic material applied to the distal end of the nozzle needle to adjust at least one of an area of the lipophobic material and a thickness of the lipophobic material, so that the lipophobic material forms a predetermined coating layer in the distal end of the nozzle needle.